

1 REMARKS

2 Status of the Claims

3 Claims 1, 2, 5-16, 19-28, 31-81, 83-87, 89-92, 94-99, and 111-123 are pending in the present
4 application, Claims 100-110 having been canceled in the present amendment as being directed to
5 non-elected claims (in response to a restriction requirement), Claims 3, 4, 17, 18, 29, 30, 82, 88
6 and 93 having been further cancelled, and new Claims 111-123 having been added. Claims 1, 7, 13,
7 31-34, 56, 76, 79, 80, 83, 84, 89 and 94 have been amended to more clearly distinguish over the cited
8 art, and Claims 5, 19, 21-28, and 48 having been amended to address dependency issues caused by
9 the amendments to other claims.

10 Claims Rejected under 35 U.S.C. § 112

11 The Examiner has rejected Claims 13-61 under 35 U.S.C. § 112, second paragraph, as being
12 indefinite. The Examiner has asserted that the term "quality of a chemical product" is indefinite.
13 Applicants have substantially amended independent Claim 13, and the language triggering the
14 indefiniteness rejection is no longer included within the claim. Accordingly, the rejection of
15 Claims 13-61 as being indefinite should be withdrawn.

16 Claims Rejected under Double Patenting

17 The Examiner has rejected Claims 1, 3, 7, 13, 15-17, 32, 33, 76-78, and 80-82 under the
18 judicially created double patenting doctrine of obviousness type double patenting, as being
19 unpatentable over Claims 3, 4 and 20-21 of U.S. Patent No. 6,537,506. The Examiner correctly notes
20 that such rejections may be obviated by filing a terminal disclaimer, which requires that the subject
21 matter of each patent remain commonly assigned, and the claims in the latter application be limited to
22 the term of the claims in the earlier filed application. However, in order to further distinguish the
23 present invention over additional cited art, independent Claims 1, 13, and 76 have been amended to
24 incorporate additional elements. For example, Claim 1 has been amended to incorporate elements
25 from Claim 4; Claim 13 has been amended to incorporate elements from Claim 18; and Claim 76 has
26 been amended to incorporate elements from Claims 83, 88, and 93. Accordingly, it does not appear
27 that the judicially created double patenting rejection applies to the claims as thus amended, and this
28 rejection should be withdrawn.

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1 Claims Rejected under 35 §. U.S.C. § 102

2 The Examiner has rejected Claims 1, 3, 13, 15-17, 31, 32, 34, 76, 79-82, and 94 under
3 35 §. U.S.C. § 102(b) as being anticipated by Giddings (U.S. Patent No. 4,894,146). Applicants have
4 amended the claims to further distinguish over the cited art, as described in detail below.

5 Referring to independent Claim 1, applicants have amended Claim 1 to incorporate the
6 patentable subject matter recited in Claim 4. Since the Examiner has already indicated that Claim 4
7 would be allowable if rewritten in the independent form, it is evident that Claim 1 as amended
8 distinguishes over the cited art. Because each dependent claim is patentable for at least the same
9 reasons as the independent claim from which it depends, Claims 2 and 5-12 are patentable for at least
10 the same reasons as Claim 1. Accordingly, the rejection of Claims 1, 2 and 5-12 as being anticipated
11 by Giddings should be withdrawn (note that Claims 3 and 4 have been canceled).

12 Referring now to independent Claim 13, applicants have amended Claim 13 to incorporate the
13 patentable subject matter recited in Claim 18. While the Examiner did not specifically object to
14 Claim 18, it is significant that the only rejection to Claim 18 appears to be based on the indefiniteness
15 rejection of Claim 13, which as discussed above, has been rendered moot by the amendments to
16 Claim 13. Furthermore, the subject matter of Claim 18 (currently incorporated into Claim 13) is
17 similar to that of Claim 4 (to which the Examiner has objected), indicating that the sequential reaction
18 units and bypass originally recited in Claim 18 and added to Claim 13 are novel features of the
19 present invention. Since the Examiner has already indicated that Claim 4 would be allowable if
20 rewritten in the independent form, it is evident that Claim 13 as amended distinguishes over the cited
21 art for substantially the same reasons. Because each dependent claim is patentable for at least the
22 same reasons as the independent claim from which it depends, Claims 14-16, 20-28, 31-47, and 56-61
23 are patentable for at least the same reasons as Claim 13. Accordingly, the rejection of
24 Claims 13-16, 20-28, 31-47, and 56-61 as being anticipated by Giddings should be withdrawn (note
25 that Claims 17, 18, 29, and 30 have been cancelled; and Claim 48 has been amended to depend from
26 new Claim 117, which also affects the ultimate dependency of Claims 49 – 55 because they depend
27 from Claim 48).

28 Turning now to independent Claim 76, , applicants have amended Claim 76 to incorporate the
29 patentable subject matter recited in Claims 83, 88, and 93. Since the Examiner has already indicated
30 that Claims 83-93 would be allowable if rewritten in the independent form, it is evident that Claim 76

1 as thus amended distinguishes over the cited art. Because each dependent claim is patentable for at
2 least the same reasons as the independent claim from which it depends, Claims 77-81, 83-87, 89-92,
3 and 94-99 are patentable for at least the same reasons as Claim 76. Accordingly, the rejection of
4 Claims 76-81, 83-87, 89-92, and 94-99 as being anticipated by Giddings should be withdrawn (note
5 that Claims 82, 88 and 93 have been canceled).

6 Patentability of Newly Added Claims 111-123

7 The Examiner has indicated that Claims 2, 4-6, 8-12, 83-93 and 95-99 are objected to as being
8 dependent upon a rejected based claim, but would be allowable if rewritten in independent form,
9 including all of the limitations of the base claim and any intervening claims. The Examiner
10 specifically notes that Claims 4 and 95 recite the feature of a bypass fluid path for reactants, Claims 8
11 and 83 recite the feature of a bifurcated opening as means for equalizing residence time of the
12 reactants in the reactor, and Claim 93 recites the feature of openings of different lengths in a single
13 simple plate as means for enhancing flow in the reactor.

14 Applicants have added new Claims 111-122, which include various combinations of the
15 subject matter that the Examiner has indicated is patentable. The elements recited in the newly added
16 claims already were included in the claims as originally filed (with the exception of new Claim 112),
17 hence, applicants have not raised any new issue requiring a further search with this amendment.
18 Furthermore, each of these elements in the new claims is fully disclosed supported in the
19 specification and drawings as filed. Applicants have further added new Claim 123, which differs
20 slightly from original Claim 1. The patentability of new Claim 123 will be discussed in detail below.

21 New Claim 111 represents Claim 2 (to which the Examiner has objected) rewritten in
22 independent form. Accordingly, it will be evident that Claim 111 should be allowed.

23 New Claim 112 represents Claim 3 (which the Examiner originally rejected) rewritten in
24 independent form, but including the additional element of achieving internal parallelization by
25 providing at least two parallel fluid flows in different layers of the stacked plate reactor that are not in fluid
26 communication. Giddings discloses internal parallel fluid paths; however, the internal parallel fluid paths
27 disclosed by Giddings are in fluid communication with each other. In contrast, the internal parallelization
28 achieved in the present invention as defined by Claim 112 is not limited to internal fluid paths that are in
29 fluid communication with one another. For example, plates 110 and 210 of FIGURE 26 each include a
30 plurality of mixing and reaction volumes defined by openings in their respective simple plates. Those

1 mixing and reaction volumes are examples of internal parallelization of fluid paths that are not in fluid
2 communication with one another and which are achieved in different layers of the reactor. This type of the
3 internal parallelization is clearly described and illustrated in the specification as filed, but does not appear to
4 be taught or suggested in the prior art. Accordingly, Claim 112 should be allowed.

5 New Claim 113 combines the patentable elements of Claim 2 with Claim 13 (without the
6 language that the Examiner has indicated is indefinite). While this combination achieves a claim that
7 is a slightly different than would be achieved by rewriting Claim 2 in independent form (i.e., as was
8 done for Claim 111), Claim 113 is patentable for at least the same reasons as Claim 111.
9 Accordingly, Claim 113 should be allowed.

10 New Claim 114 combines the recitation of Claim 13 with that of Claim 31, which appears to
11 distinguish over the cited art. Claim 31 (and new Claim 114) define a heat exchanger that includes
12 a plurality of heat exchanger fluid channels extending "*substantially orthogonal to a plurality of*
13 *fluid channels for directing a flow of at least one of a chemical reactant and a chemical product,*
14 *such that the plurality of heat exchanger fluid channels are not in fluid communication with the*
15 *plurality of fluid channels for directing a flow of at least one of the chemical reactant and the*
16 *chemical product.*" This configuration is clearly illustrated in FIGURE 26. Plate 30 (which
17 defines a heat exchanger) includes a plurality of fluid channels that are substantially orthogonal to
18 the plurality of reactant fluid channels in plate 50. This orthogonal orientation does not appear to
19 be taught or suggested by the cited art. The Examiner appears to indicate that inlet 30 in Giddings
20 (see FIGURE 6 of Giddings) is equivalent to a plurality of heat exchanger fluid channels that are
21 substantially orthogonal to a plurality of a reactant fluid channels, but this position does not appear
22 to be reasonable. First, Giddings does not teach or suggest that inlet 30 is used to introduce a fluid
23 for heat exchange purposes. In fact, Giddings indicates that inlet 30 is used to introduce an
24 additional non-sample fluid for the purposes of the removing particulates from the sample fluid
25 introduced at inlet 26. Furthermore, even if inlet 30 is used to introduce a heat transfer fluid into
26 Giddings' structure, it appears that that heat transfer fluid would flow *in parallel* with the sample
27 and non-sample fluid already inside Giddings' structure (in particular, note that the arrow
28 associated with inlet 30 points in the same direction as the arrows associated with inlets 25 and 26,
29 indicating a parallel flow, *not* an orthogonal flow). Finally, it should be noted that a fluid
30 introduced through inlet 30 will be in fluid communication with the fluids introduced through

1 inlets 25 and 26; thus, Giddings does not teach or suggest a plurality of heat exchanger fluid
2 channels substantially orthogonal to a plurality of other fluid channels, where the heat exchanger
3 fluid channels are not in fluid communication with the other plurality of fluid channels.

4 Applicants further respectfully note that the device disclosed by Giddings *is not* a reactor. Giddings
5 clearly teaches that his device is apparatus for separating small particles into desired fractions using a
6 sample fluid and a non-sample fluid configured to achieve a laminar flow relationship with one another so
7 that particulates entrained in the sample fluid migrate into the non-sample fluid. While it may be
8 theoretically possible that the structure disclosed by Giddings could be used as a chemical reactor (where
9 two or more reactants chemical reactants are mixed together so that a chemical reaction occurs within the
10 reactor), Giddings does not teach or suggest using the device he describes, in this manner. It is apparent that
11 one of ordinary skill in the chemical arts would NOT be led to use a device developed for separating
12 particles from a fluid, as a chemical reactor.

13 It should further be noted that new Claim 114 includes product quality language similar to language
14 the Examiner originally rejected as being indefinite with respect to original Claim 13. However, applicants
15 have included other language that avoids a similar indefiniteness rejection. Specifically, Claim 114 recites
16 *"wherein a relatively higher quality product is characterized by at least one of a relatively higher yield and*
17 *the presence of relatively fewer byproducts, and a relatively lower quality product is characterized by at*
18 *least one of a relatively lower yield and the presence of relatively more byproducts."* This language is fully
19 supported by the first paragraph of page 79 of the specification as filed, which clearly indicates that the
20 quality of a product can be defined in terms of the yield and the presence of byproducts in the product.
21 Those of ordinary skill in the chemical arts will readily recognize that if a first chemical product includes
22 relatively more byproducts than a second chemical product, the first chemical product will be considered to
23 be of a lower quality than the second chemical product. Those of ordinary skill in the chemical arts will also
24 readily recognize that yield is often used to evaluate the quality of a chemical product. Yield refers to how
25 much of the reactants have been converted into a chemical product. If the relative proportions of a first and
26 second reactant are carefully selected, theoretically, 100% of the first and second reactants can be converted
27 into a chemical product. However, under real-world process conditions, a 100% yield is rarely achievable.
28 Furthermore, the same relative proportions of the first and second reactant introduced into different reactors
29 (or into the same reactor under a different process conditions) often achieve different yields of the same
30 chemical product (i.e., more or less chemical product is generated using the same amount of reactants where

1 different reactors or different process conditions are utilized). Those of ordinary skill in the art will readily
2 recognize that a first chemical product produced under conditions resulting in a first yield can be considered
3 to be a higher quality product as compared with the same chemical product produced under conditions
4 resulting in a smaller yield. Thus, the language included in Claim 114 is supported by the specification, and
5 is not indefinite to one of ordinary skill in this art. Accordingly, Claim 114 should be allowed without any
6 objection to this language regarding quality of the product.

7 New Claims 115 and 116 combine elements of Claim 13 (without the language that the
8 Examiner has indicated is indefinite) with elements of Claims 29 and 30 (respectively), each of which
9 appears to distinguish over the cited art. Claims 29 and 30 (and new Claims 115 and 116) define a
10 reactor including a plurality of reaction units and a bypass fluid path. It should be noted that
11 Claims 29 and 30 appear to have been originally rejected because the independent claim upon which
12 they depend (Claim 13) had been rejected for indefiniteness. Based on other claims to which the
13 Examiner objected, it appears that the elements of a plurality of reaction units and a bypass fluid path
14 are novel features of the present invention as defined by these new claims. Accordingly, Claims 115
15 and 116 should be allowed.

16 New Claim 117 combines the recitation of Claim 13 (without the language that the Examiner
17 has indicated is indefinite) with recitation of Claim 47, which appears to distinguish over the cited
18 art. Claim 47 (and new Claim 117) define a reactor including a plurality of openings having different
19 widths disposed in at least one simple plate, the different widths being selected to provide a substantially
20 even flow equipartition for a fluid flowing through a plurality of different width fluid channels defined by
21 the plurality of openings having different widths. It should be noted that Claim 47 appears to have been
22 originally rejected because the independent claim upon which it depended (Claim 13) had been
23 rejected for indefiniteness. Based on other claims to which the Examiner objected (such as
24 Claim 88), it appears that the element of a plurality of openings having different widths is a novel feature
25 of the present invention. Accordingly, Claim 117 should be allowed.

26 New Claim 118 corresponds to rewriting Claim 83 (to which the Examiner has objected) in
27 independent form. Accordingly, it will be evident that Claim 118 should be allowed.

28 New Claim 119 corresponds to rewriting Claim 88 (to which the Examiner has objected) in
29 independent form. Accordingly, it will be evident that Claim 119 should be allowed.

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1 New Claim 120 corresponds to rewriting Claim 93 (to which the Examiner has objected) in
2 independent form. Accordingly, it will be evident that Claim 120 should be allowed.

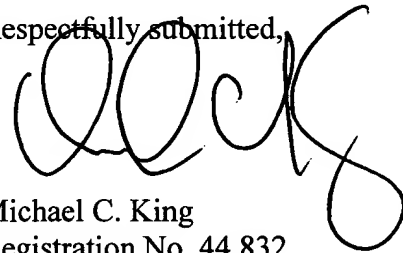
3 New Claims 121 and 122 combine the recitation of Claims 1 and 76 (as amended). These
4 claims define a stacked plate reactor including at least one of: (1) a bifurcated fluid channel (based
5 on Claim 83, to which the Examiner has objected); (2) a plurality of openings having different widths
6 (based on Claim 88, to which the Examiner has objected); (3) a plurality of openings having different
7 lengths (based on Claim 93, to which the Examiner has objected); and (4) a plurality of reaction units
8 and a bypass fluid path (based on Claim 4, to which the Examiner has objected). Accordingly, it will
9 be evident that Claims 121 and 122 should be allowed.

10 As noted above new Claim 123 includes much of the recitation of original Claim 1, with a
11 minor amendment making it clear that the heat transfer fluid path is *not* coupled in fluid
12 communication with the reactant fluid paths. Claim 123 is therefore distinguishable over Giddings,
13 because Giddings does not teach or suggest a heat exchanger coupled in fluid communication with a
14 fluid path for a heat transfer medium. Giddings discloses a device including an internal volume and a
15 plurality of fluid inlets. Giddings specifically teaches that a sample fluid including a plurality of
16 particulates is introduced into a first fluid inlet, and a non-sample fluid is introduced into a second
17 fluid inlet, such that a laminar flow between the sample fluid and the non-sample fluid is achieved,
18 enabling particulates in the sample fluid to migrate to the non-sample fluid. Because the additional
19 fluid inlets *are in fluid communication* with the internal volume, it would not be practical to
20 introduce a heat transfer fluid into one of the additional fluid inlets, because that heat transfer fluid
21 would undesirably mingle with the sample and non-sample fluids in the internal volume. Giddings
22 specifically suggests that non-sample fluids having different pH values could be introduced into these
23 different fluid inlets, enabling pH conditions inside the internal volume to be manipulated. However
24 Giddings does not teach or suggest changing the temperature of the internal volume by introducing
25 heat transfer fluid using these additional fluid inlets. Because new Claim 123 positively recites that
26 the heat transfer fluid path is *not* coupled in fluid communication with the reactant fluid paths, it is
27 evident that the device disclosed by Giddings is not equivalent to the claimed invention, because each
28 of fluid inlets in Giddings' device are coupled in fluid communication with the same internal volume.
29 There is simply no basis for concluding that it would have been obvious to modify Giddings'
30 particulate separation device to achieve the claimed chemical reactor. The cited art does not teach or

1 suggest such a modification, and there is not any evidence that an artisan of ordinary skill would have
2 been motivated to modify Giddings' device to solve a problem known to the art. Accordingly, new
3 Claim 123 is distinguishable over Giddings.

4 In view of the amendments and Remarks set forth above, it will be apparent that the claims in
5 this application define a novel and non-obvious invention, and that the application is in condition for
6 allowance and should be passed to issue without further delay. Should any further questions remain,
7 the Examiner is invited to telephone applicants' attorney at the number listed below.

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9 Respectfully submitted,

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13 Michael C. King
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14 MCK/RMA:

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16 I hereby certify that this correspondence is being deposited with the U.S. Postal Service in a sealed
17 envelope as first class mail with postage thereon fully prepaid addressed to: Commissioner for Patents,
Alexandria, VA 22313-1450, on December 30, 2004.

18 Date: December 30, 2004

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